

Newsletter

Volume 8, Number 5
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Directors Note

The work of scientists is rarely an isolated endeavor. Today's research is based in part on data that have been collected and made available by scientists in the past. Data being collected, analyzed and reported today will be used in turn by researchers of the future. This growing pyramid of knowledge is the essence of science.

Donna Ashizawa, a student in the 1991 Research Experiences for Undergraduates program at the Institute, made use of scientific records dating from the early part of this century in her study of temperature change in the Hudson River. This work is described in our cover story. At the same time, IES ecologists continually contribute to an ever-expanding pool of data on the environment, data that will serve as the basis for studies by the world's scientists long into the future. To help our readers understand how scientific knowledge is spread in this way, we have included in "IES Notes" a list of some of the Institute ecologists who recently have shared their research findings at scientific meetings.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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Is the Hudson River Heating Up?

In most cases, the only way to evaluate environmental change is over the long-term . . . 10, 20 or 50 years of observations are more apt to give an accurate picture of an environmental trend than, say, two or three dry summers or warm winters. The opportunity to use undisturbed plots at the Mary Flagler Cary Arboretum for long-term ecological studies is a real advantage for scientists at the Institute of Ecosystem Studies, and, in fact, long-term research is one of the Institute's major goals. Although increasing numbers of ecological research institutions now are pursuing sustained studies, it is unusual to find reliable environmental data that extend back more than a few decades.

Unusual, but not impossible. This was what IES aquatic microbiologist Dr. Jonathan Cole discovered last spring when he investigated projects for students in the summer's Research Experiences for Undergraduates (REU) program. Dr. Cole is interested in the phenomenon of global warming and was curious to find out whether the Hudson River, where he is doing some of his research (see the July-August 1991 issue of the *IES Newsletter*, and the Institute publication *Discoveries in Ecology*), is heating up. When he and his research assistant Benjamin Peierls contacted the chief operator of the Poughkeepsie Water Works, Douglas Fairbanks, Jr., he knew that he had come across better data than he ever could have hoped for: packed in boxes in a chemical storage area at the water treatment facility were water

temperature records dating back to 1908. These records, kept meticulously by bacteriologist Thomas A. Cole (no relation to Dr. Cole), contained data for various time periods on bacterial content, water turbidity and color, pH, flow measurements, and, most important, temperature.

Donna J. Ashizawa is an undergraduate student majoring in biology and environmental studies at Sonoma State University in California. When she saw a notice about the Institute's REU program and the list of topics for independent research, she was interested immediately in Dr. Cole's offering. She applied and was accepted for this summer's three-month program.

The early part of her REU experience was spent commuting between the Institute and the Water Works, located adjacent to the Marist College campus in Poughkeepsie. Over a three-week period she went through all the boxes of old records, from 1908 to the present (with a few gaps in the data). (The paper was in excellent condition, perhaps due in part to its proximity to those stored chemicals.) Then she entered all the relevant data into a computer at the Institute's Plant Science Building.

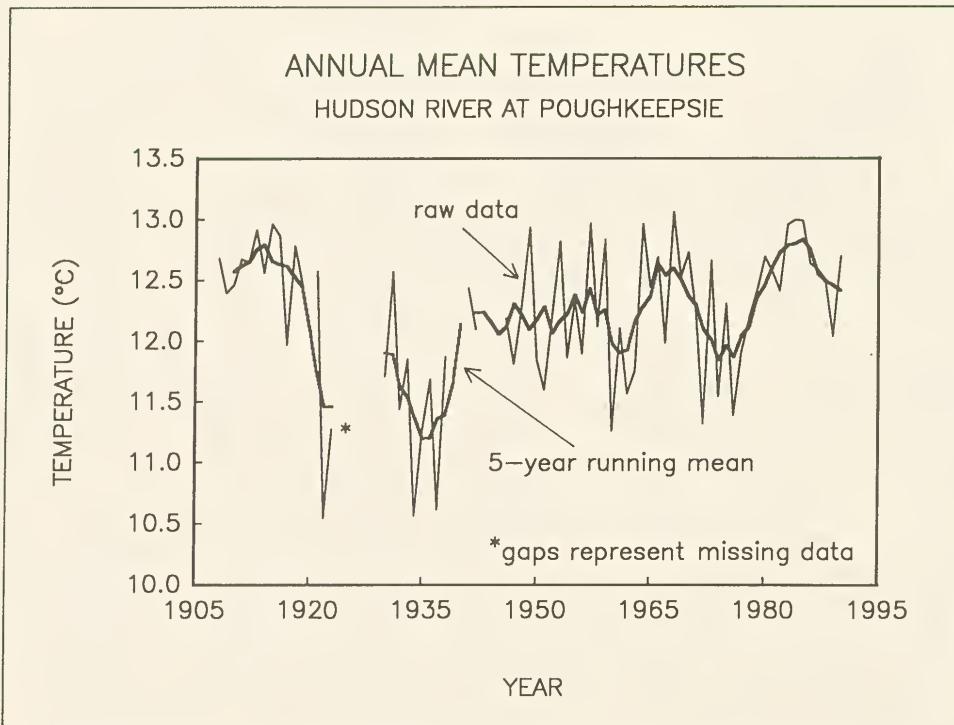
Once the data had been plotted on graphs, Ms. Ashizawa could analyze trends in temperature change. She found there was a number of short-term ups and downs, which is to be expected, with a significant and dramatic cooling of the river water from 1908 to the 1920s followed by a

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After plotting data that had been collected during an 83-year period, 1991 REU student Donna Ashizawa summarized her findings in a graph, shown here on a computer screen and enlarged on the following page.

TOM TAFT



Ms. Ashizawa's graph shows a gradual increase in the Hudson River's annual mean temperature. (Annual mean temperature is the middle point between the year's high and low water temperatures.)

slower warming trend from then to the present. Since the 1920s, river temperatures have increased an average of 0.12°C (0.2°F) each decade, a value that falls within the predicted range for global warming of 0.06 to 0.8°C (0.1 to 1.4°F) per decade. The fastest overall increase occurred from 1971 to 1990. In her presentation at the public symposium that concluded the REU program, Ms. Ashizawa added that while she had not looked into possible reasons for cooler waters during the early part of the century, one reason might have been a gradual reforestation of the upper reaches of the river's watershed. Parts of the Adirondack Mountains had been logged extensively during the late 1800s, meaning higher levels of sunlight on river tributaries. As trees grew back, lower water temperatures could have reflected the increase in shade.

Water temperatures are less apt to fluctuate from day to day than are air temperatures, which makes them more reliable as indicators of long-term trends. To supplement her river data, however, Ms. Ashizawa was able to get air temperature data from the Mohonk Preserve and will analyze those figures, correlating them with river temperatures, while she carries on her studies at the university this fall. Her final report is due late this year and will be included with the other REU students' reports in an IES Occasional Publication.

The REU Program

If the United States is to remain strong in the sciences, the interest and imagination of students must be stimulated. To help achieve this goal the National Science Foundation (NSF) sponsors Research Experiences for Undergraduates, a program that enables selected institutions to involve students in challenging and relevant research. In 1988, Institute of Ecosystem scientists Dr. Alan R. Berkowitz, Dr. Steward T.A. Pickett and Dr. Stuart E.G. Findlay wrote a proposal to NSF requesting funds to support an REU program at the Institute. That year IES was awarded one of only six REU grants in the field of ecological science. Proposals were funded again in 1989 and 1990, and in spring 1991 the efforts of IES scientists and students alike were rewarded when the Institute received a three-year REU grant.

Out of 80 undergraduate students from across the United States who applied for positions in the 1991 IES program, 10 were selected. The following students spent June, July and August at the Institute, doing independent research in collaboration with an IES mentor scientist:

• Miles Arnott (East Stroudsburg State University, Pa.): *The effect of elevation and vegetation type on pollutant deposition to the Catskill Mountains.* K.C. Weathers and Dr. G.M. Lovett, mentors.

• Donna Ashizawa (Sonoma State University, Calif.): *The long-term temperature trends of the Hudson River: a study of the historical data.* Dr. J.J. Cole, mentor.

• Kimberly I. Gould (Russell Sage College, N.Y.): *Microbial metabolism of dissolved organic carbon in shallow groundwater.* Dr. S.E.G. Findlay, mentor.

• Cheikh Goumbala (Univ. of the District of Columbia): *Microbial metabolism of dissolved organic carbon in shallow groundwater.* Dr. S.E.G. Findlay, mentor.

• Nicholas Lewin (San Francisco State University, Calif.): *Heterogeneity in oldfields and meadow vole runway systems.* Drs. R.S. Ostfeld and S.T.A. Pickett, mentors.

• Patrick J. Moran (Tufts University, Mass.): *Insect responses to mechanical damage on cottonwood, Populus deltoides.* Dr. V.A. Krischik, mentor.

• Christian Petrovich (Prescott College, Ariz.): *Understanding cottonwood response to damage and stress: a search for mechanisms in an apparent chaos of results.* Dr. C.G. Jones, mentor.

• Simon H. Scott, III (Norfolk State University, Va.): *The effects of resource manipulation on seedling establishment in intact successional communities.* Drs. A.R. Berkowitz and C.D. Canham, mentors.

• Chris Seidler (University of California at Santa Cruz): *Some effects of UV-B radiation on plant-herbivore interactions.* Drs. V.A. Krischik, C.G. Jones and S.E.G. Findlay, mentors.

• Susan Waters (Hampshire College, Mass.): *The influence of forest edge and elevation on nitrogen mineralization and foliar nitrogen in red spruce stands.* K.C. Weathers and Dr. G.M. Lovett, mentors.

To give the REU students as broad an exposure to science as possible, the Institute scheduled "Research Strategies" sessions to teach methods for doing research, interpreting results and communicating findings, and "Research in Context" seminars to explore the roles of ecology and ecologists in society. During a late July "Forum on Opportunities in Ecology," students met with professionals who use their ecological background in a variety of research and non-research careers, and at the end of the three-month period the young scientists presented their findings in a public symposium. The IES Occasional Publication with the 1991 students' final reports will be published in 1992; copies of previous years' reports are available from the Institute's Education Program office.

IES Notes

• One way in which research and education findings and theories are disseminated is at meetings and workshops. Over the past several months, a number of Institute scientists and educators have participated in **national and international meetings**. Among these are:

Dr. Alan Berkowitz: (see article below)

Dr. Paul Bukaveckas: International Conference on Environmental Geochemistry, Uppsala, Sweden. Presenter, "Long-term changes in the chemistry of inlet and outlet streams in the Mirror Lake Watershed."

Dr. Nina Caraco: Third International Workshop on Phosphorus in Sediments, The Netherlands.

Dr. Charles Canham: International Association of Vegetation Science meeting, Hungary. Presenter, "Factors controlling tree invasion in oldfields."

Ms. Kathleen Hogan: Association of Science and Technology Centers, Louisville. Attended a Teacher Educators' Network workshop, and met with the Eco-Inquiry National Dissemination Team.

Dr. Vera Krischik: Entomological Society of America, Reno. Moderator, "Chemical

resistance to insects and diseases."

Dr. Gary Lovett: Fifth International Conference on Precipitation Scavenging and Atmosphere-Surface Exchange Processes, Richland, Wash. Presenter, "Dry deposition of sulfur to the Hubbard Brook Experimental Forest: A preliminary comparison of methods."

Dr. Mark McDonnell, Dr. Kim Medley, Ms. Judiane Koch: World Congress of Landscape Ecology, Ottawa. Dr. McDonnell ran a workshop entitled "Landscape Ecology and Training Programs." Dr. Medley and

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Excellence in Ecology Education

Never before has there been a time when there was more interest in, and concern about, ecology, more use of the terms "ecosystem" and "environment" . . . and less understanding of what it all means.

Ecology is the scientific study of ecosystems—organisms and their environments—and serves as one of the key underpinnings of the broader field of environmental studies. Thus, ecologists committed to education have an important role to play in providing scientific background for studies of the local, regional and global environment, and, given today's heightened awareness, an excellent opportunity to communicate the excitement of science to students. One of the goals of the Institute of Ecosystem Studies, and of ecology educators everywhere, is to promote excellence in science education and to foster ecological literacy.

IES ecologist and head of education Dr. Alan R. Berkowitz recently organized a

"Workshop on Ecology Education" at an Ecological Society of America (ESA) meeting held in August in San Antonio. Dr. Berkowitz has been active in the education initiatives of the ESA for many years, and reports a growing interest in ecology education. "Over 1000 of our 6000 members responded to a recent survey on education, and more than 100 participated in a 1990 workshop focusing on working with children and teachers." The goal of the 1991 workshop was to begin mapping out an agenda for the ESA to become an active player in ecology education at all levels. In preparation, Dr. Berkowitz worked with colleagues on the ESA Committee for the Education of Young Children to produce two draft publications that were distributed to workshop participants: *Ecology Education for Children: A Framework for Excellence* summarizes the principles for achieving excellence in ecology education; *Ecology Education for Children: A Handbook for Ecologists* suggests ways in which ecolo-

gists can contribute to the ecological literacy of young children. These drafts will be refined and more widely distributed during the next two years.

The 16 workshop participants identified ten "action items" that will be implemented to achieve their goal. Published recently in the newsletter of the ESA Education Section, these items include the scheduling of regional workshops and networks to inform ecologists about—and involve them in—the improvement of pre-college science education, and the establishment of formal liaisons between the ESA and science and environmental education organizations at a national level. Another high priority item is to provide schools with information about plants and animals that are found in or near the schoolyards and that are useful for teaching ecology and natural history. The goal here is to make sure that by the year 2000 every school in the country has access to such information.

What do you think . . . about the role of ecology in education? As IES NEWSLETTER readers, your interest and involvement in ecology make your opinions valuable, and Dr. Berkowitz would appreciate your comments:

1. What have been your most significant ecological learning experiences?
2. Should we ensure that every child has at least a minimum amount of outdoor science study in school?
3. Should prospective teachers be required to have a specified level of ecological literacy?
4. How can the goals of ecology education be achieved while complementing those of other science education movements?

Please send your ideas, on this form or on a separate sheet, to Dr. A.R. Berkowitz, IES, Box AB, Millbrook NY 12545 — *Thank you!*

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Ms. Koch each collaborated with Dr. McDonnell on a poster presentation.

Dr. Michael Pace: Evolutionary, Population and Community Response to Global Change meeting, Univ. of Washington, Friday Harbor. Discussion leader, "Global Change and Community Ecology."

Dr. David Strayer: Workshop on Biological Invasions of the Great Lakes, Great Lakes Fishery Commission Board of Technical Experts, Ann Arbor, Mich. Invited participant.

Kathleen Weathers: Fifth International Conference on Precipitation Scavenging and Atmosphere-Surface Exchange Processes, Richland, Wash. Presenter, "The influence of a forest edge on cloud deposition."

Raymond Winchcombe: Fifth Eastern Wildlife Damage Control Conference, Ithaca. Presenter, "Minimizing deer damage to forest vegetation through aggressive deer population management."

• **Antarctic dry valleys** — those relatively ice-free portions of the continent — are expected to respond rapidly to climate change, and as such may be excellent environmental barometers. While these polar deserts have been studied by biologists and geologists for several decades, there has been little ecosystem level research there. In an attempt to begin to understand the flow of energy and the movement of materials and organisms in the dry valleys, a three-day workshop was held at the Institute of Ecosystem Studies in October. Thirty-five scientists, including IES ecologists and scientists from the U.S., Canada, England, Japan, Australia and New Zealand, met to consider research priorities and activities as applied to the terrestrial, lotic (glaciers, streams) and lake ecosystems of Antarctica.

Winter Calendar

CONTINUING EDUCATION PROGRAM

The winter semester will begin in mid-January, with classes and workshops in landscape design and gardening, and ecological excursions. Among this semester's special programs are:

Feb. 1: **Ornamental Grasses in the Garden**

Feb. 15: Workshop: **Bringing Out the Best in Shrubs**

Feb. 19: **All About Annuals**

Catalogues with all the winter and spring offerings will be mailed to Arboretum members in mid-December. If you are not a member and would like a catalogue, call the number below and we will send one to you.

SUNDAY ECOLOGY PROGRAMS

Free public programs are held on the first and third Sunday of each month, except over holiday weekends. Programs begin at 2 p.m. at the Gifford House on Route 44A unless otherwise noted. Call (914) 677-5359 to confirm the day's topic.

Jan. 5: **Creatures of the Cryptosphere, and Other Winter Survivors: A Hands-on Program for Kids and their Parents**, led by Kass Hogan.

Jan. 19: **The Global Carbon Dioxide Controversy**, a talk by Dr. Jonathan Cole

Feb. 3: Please call the number below
For outdoor programs, dress according to the weather. Waterproof boots are suggested. In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program.

GREENHOUSE

The IES greenhouse is a year-round tropical plant paradise as well as a site for controlled environmental research. There is no admission fee, but visitors should stop first at the Gifford House for a free permit.

For more information, call (914) 677-5359 weekdays from 8:30 – 4:30.

GIFT SHOP

Senior Citizens Days: On Wednesdays senior citizens receive a 10% discount on all purchases (except sale items).

Annual Pre-Holiday Sale: Friday, Saturday and Sunday, December 6, 7 and 8. Members receive a 20% discount on gifts and plants, and a 10% discount on books.

Annual January Sale: Everything will be discounted. Save 50% on holiday items, 20% on gifts and plants and 10% on books.

ARBORETUM HOURS

(Winter Hours: October 1 – April 30; closed on public holidays)

The Arboretum grounds are open Mon. through Sat., 9 a.m. to 4 p.m.; Sun. 1 – 4 p.m. Internal roads and trails are closed during the deer hunting season (Nov. 18 – Dec. 10).

The **Gift and Plant Shop** is open Tues. through Sat., 11 a.m. to 4 p.m. and Sun. 1 – 4 p.m. (closed weekdays from 1 – 1:30 p.m.).

Please note: The Shop will close at 2:00 p.m. on Dec. 24, and will be closed all day Dec. 25 and Jan. 1.

All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Permits are available until 3:00 p.m. daily.

MEMBERSHIP

Become a member of the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, a free subscription to the IES NEWSLETTER, and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$30; family membership is \$40. For information on memberships, contact Janice Claiborne at (914) 677-5343.

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